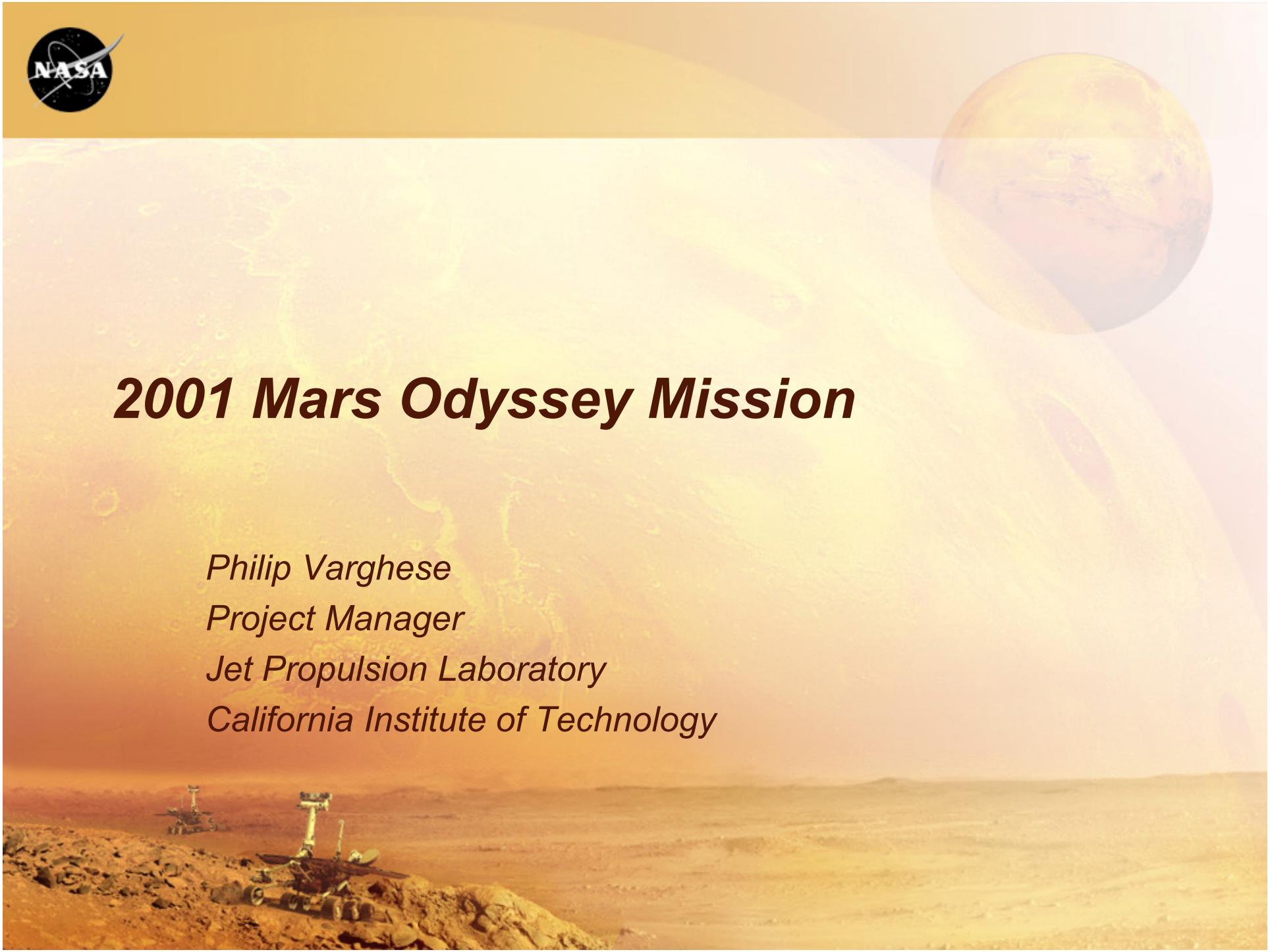

2001 Mars Odyssey Mission

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Mission Overview

Salient Features

- Mars Orbiter Launched: April 7, 2001
- Payload: GRS, HEND, MARIE, NS, THEMIS
- Primary Mission: Feb 2002 - Aug 2004
- 1st Extended Mission: Aug 2004 - Sep 2006
- 2nd Extended Mission: Oct 2006 - Sep 2008
- 3rd Extension Proposed: Oct 2008 - Sep 2010

Science

- Globally Map the Elemental Composition of the Surface
- Acquire High Spatial and Spectral Resolution Mapping of Surface Mineralogy
- Determine Abundance of Hydrogen in the Shallow Subsurface
- Provide Information on the Morphology of the Martian Surface
- Characterize Specific Aspects of the Martian Near-Space Radiation Environment
- Observe Inter-Annual Variations and Secular Changes

Current Scope of Work

- The E2 mission pursues the following science goals:
  - Monitor inter-annual and secular variations of the Mars climate system and surface processes
  - Improve the resolution of existing elemental maps and generate maps of additional key elements
  - Expand the capability of the THEMIS camera system by implementing off-nadir pointing
  - Acquire data complementary to those obtained by other spacecraft at Mars, especially MRO
- The E2 Mission provides the following operational support to other Program missions:
  - UHF relay support to MER
  - Landing site reconnaissance for PHX and MSL

Facilities

Project Management and Mission Operations

- JPL (Pasadena, CA)
  - Project Management: Risk Management, Financial Management
  - Mission Operations: Navigation, Sequencing, DSN Allocations, Ground Data Systems, Multi-Mission Ground Software Systems (MGSS/DSMS)
  - DSN
- Lockheed Martin Space Systems (Denver, CO)
  - Spacecraft Operations: Spacecraft Monitoring, Trending, Commanding
  - Systems, Subsystems, Real-time Operations, GDS

Science

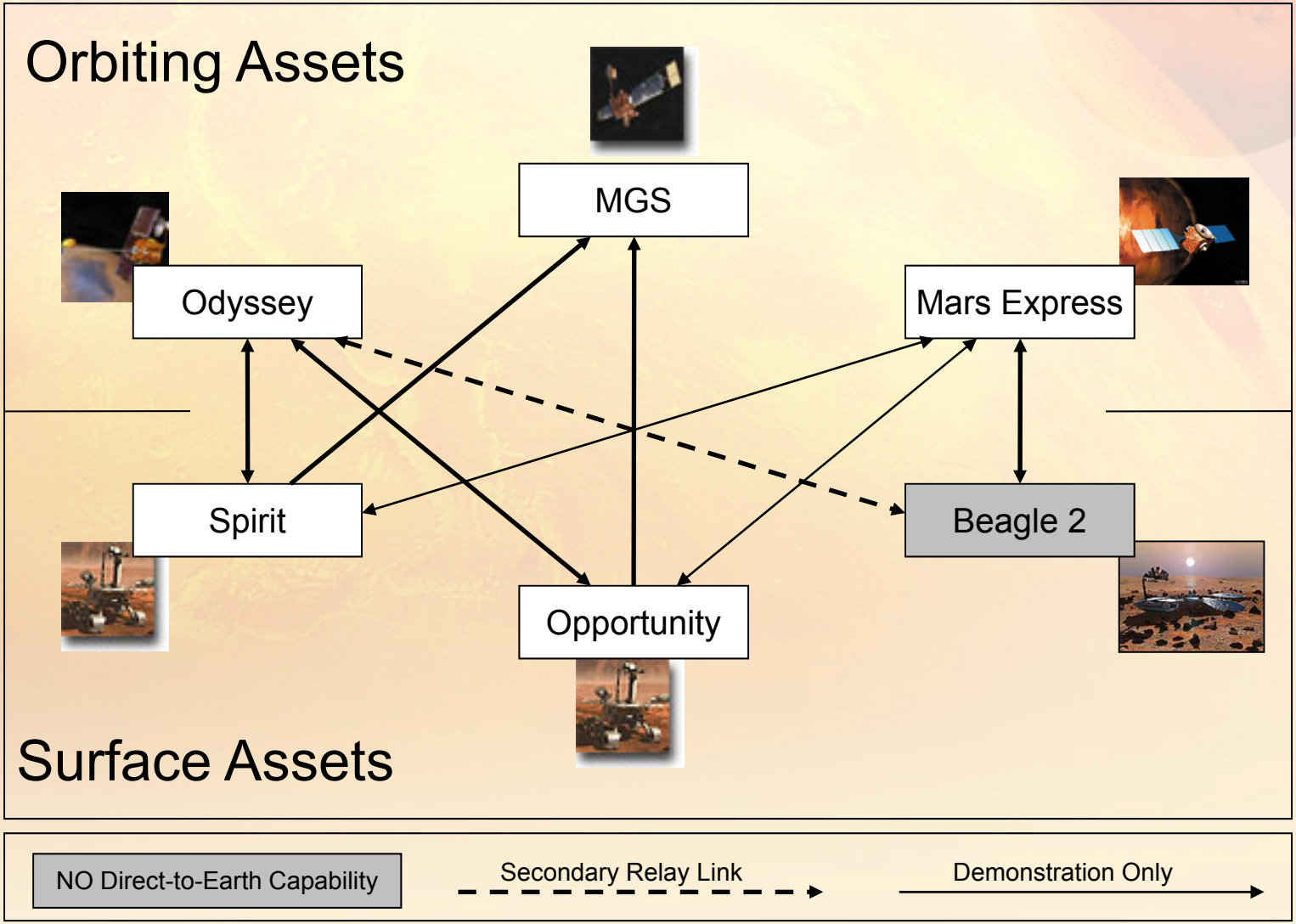
- THEMIS - Arizona State University (Tempe, AZ)
  - Mars Space Flight Facility
  - Instrument monitoring, commanding, data analysis & archiving
- GRS, HEND, NS - University of Arizona (Tucson, AZ)
  - Lunar and Planetary Lab
  - Instrument monitoring, commanding, data analysis & archiving

Critical Role of DSN

- Efficient ODY operation results from excellent support from all DSN complexes
  - Every ODY DSN pass brings critical data from four spacecraft (ODY, MER-A, MER-B & Phoenix)
- MSPA permits efficient utilization of highly subscribed DSN resources
  - ODY one of the 1st to utilize MSPA
  - MCD3 capability enables higher data rates for ODY and, thereby returns four times more science data
- Delta-DOR capability allows ODY to provide increased navigation accuracy for PHX and MSL
- ODY is the designated relay asset to bring down PHX EDL data in realtime!
  - 70m support crucial for this high visibility activity

ODY's Role in Mars Telecom Infrastructure

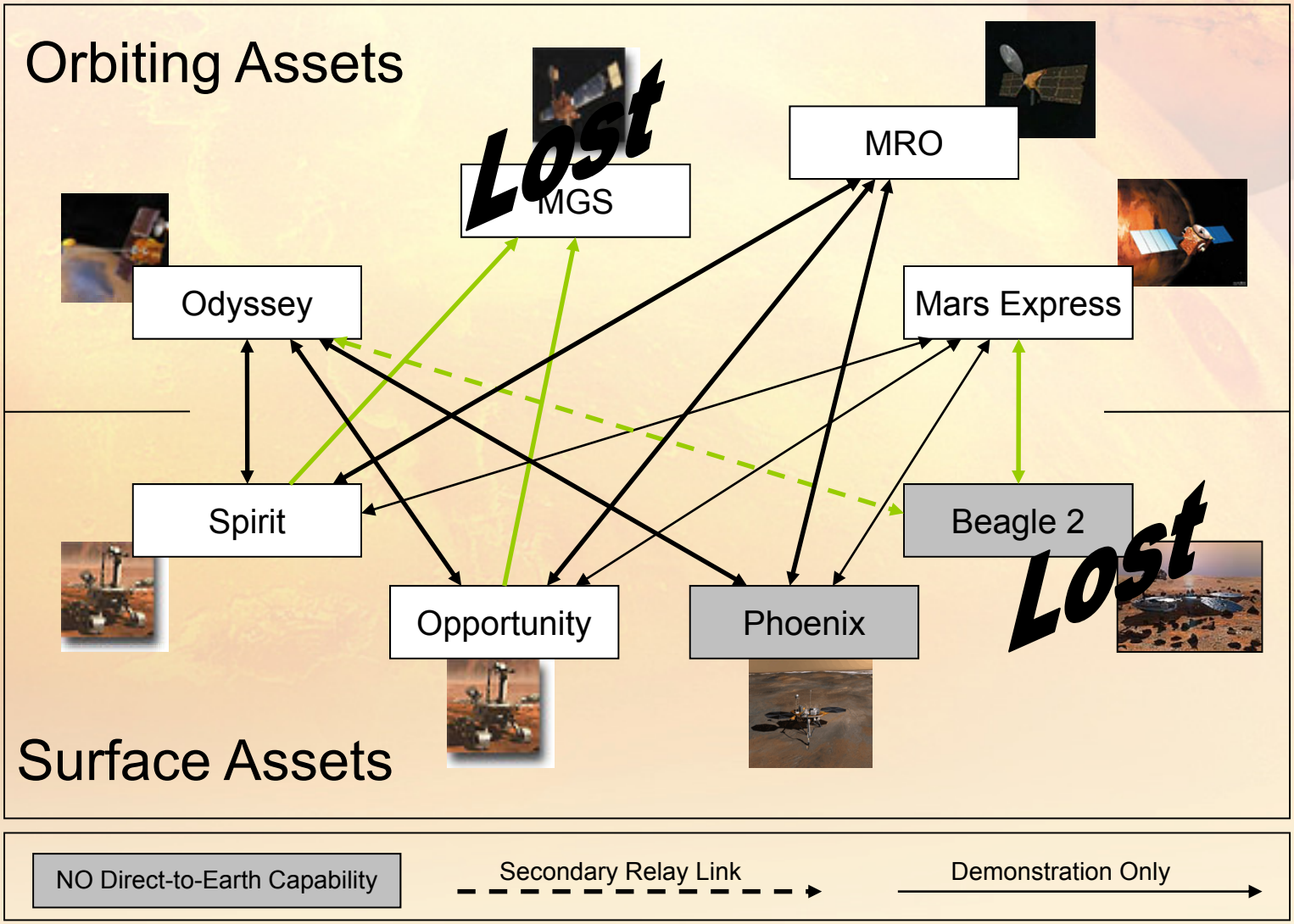
The Original Network (2003)



Relay as Mission Supplement

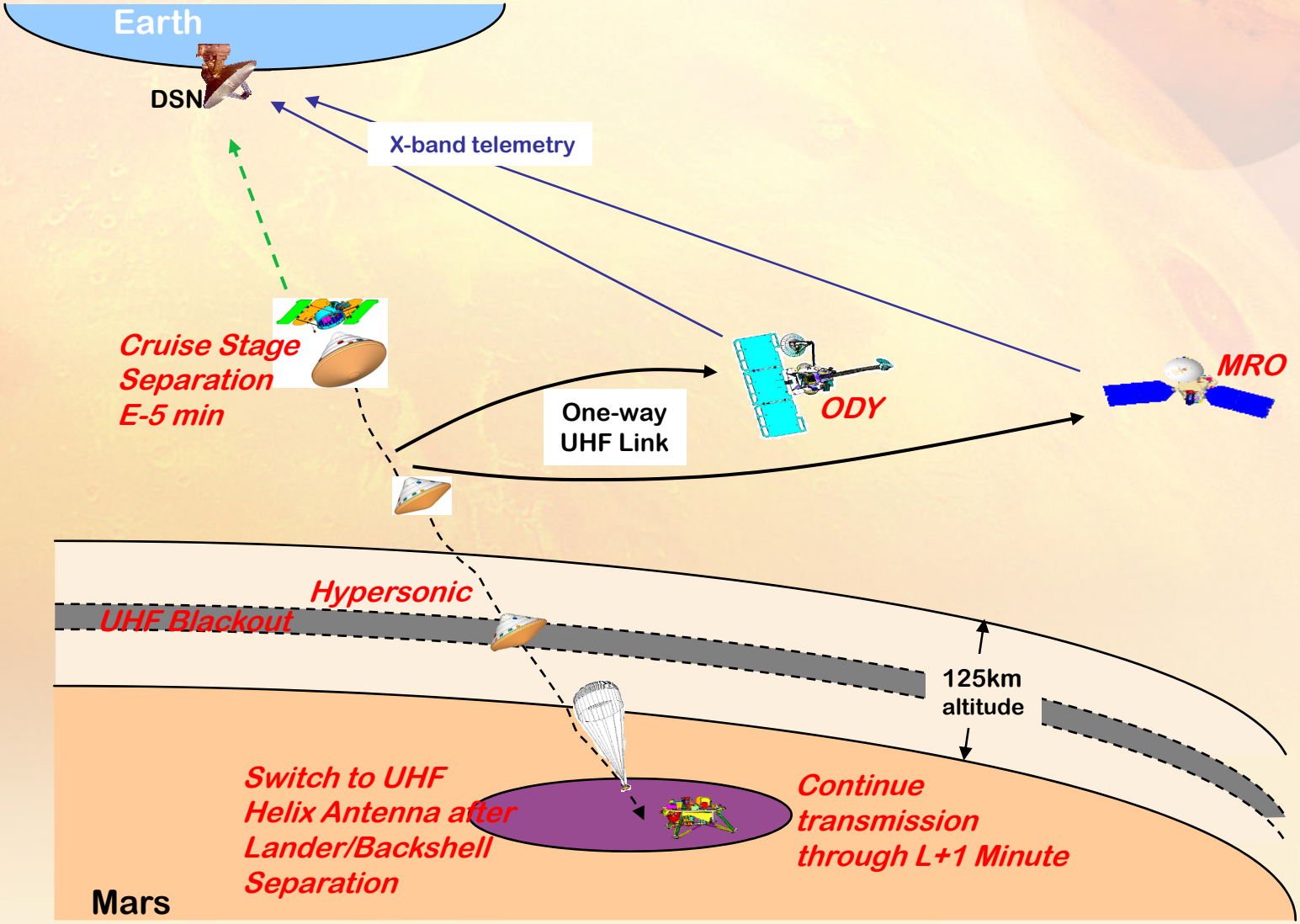
- With MER, UHF relay was considered a supplementary path to return more data. Primary success criteria relied only on X-band DTE/DFE.
- Within a week, relay operations proved itself an invaluable asset, and the focus shifted.
- As of today, well over 95% of the MER data return has come via Odyssey. X-band DFE (through the DSN) is still the primary uplink path, however.
  - It is far more energy-efficient for the lander to use UHF to a near orbiter, than X-band to distant Earth. Spend the power on science!
  - Orbiters are seldom power-starved, are unaffected by dust storms, etc.
  - ODY has been used for commanding (MRO aerobraking, FSW loads)
  - Once the data are on-board ODY, they look just like another instrument's data
- Beagle-2 was always planned as relay-only, but the Odyssey contribution was planned as a temporary measure until Mars Express was on station.
  - Early "search and rescue" operations relied heavily on the ODY flexibility, but alas, ultimately proved fruitless
- Phoenix learned from MER, and will use only UHF relay for surface ops, no X-band DTE/DFE capability exists.

Current Mars Telecom Infrastructure

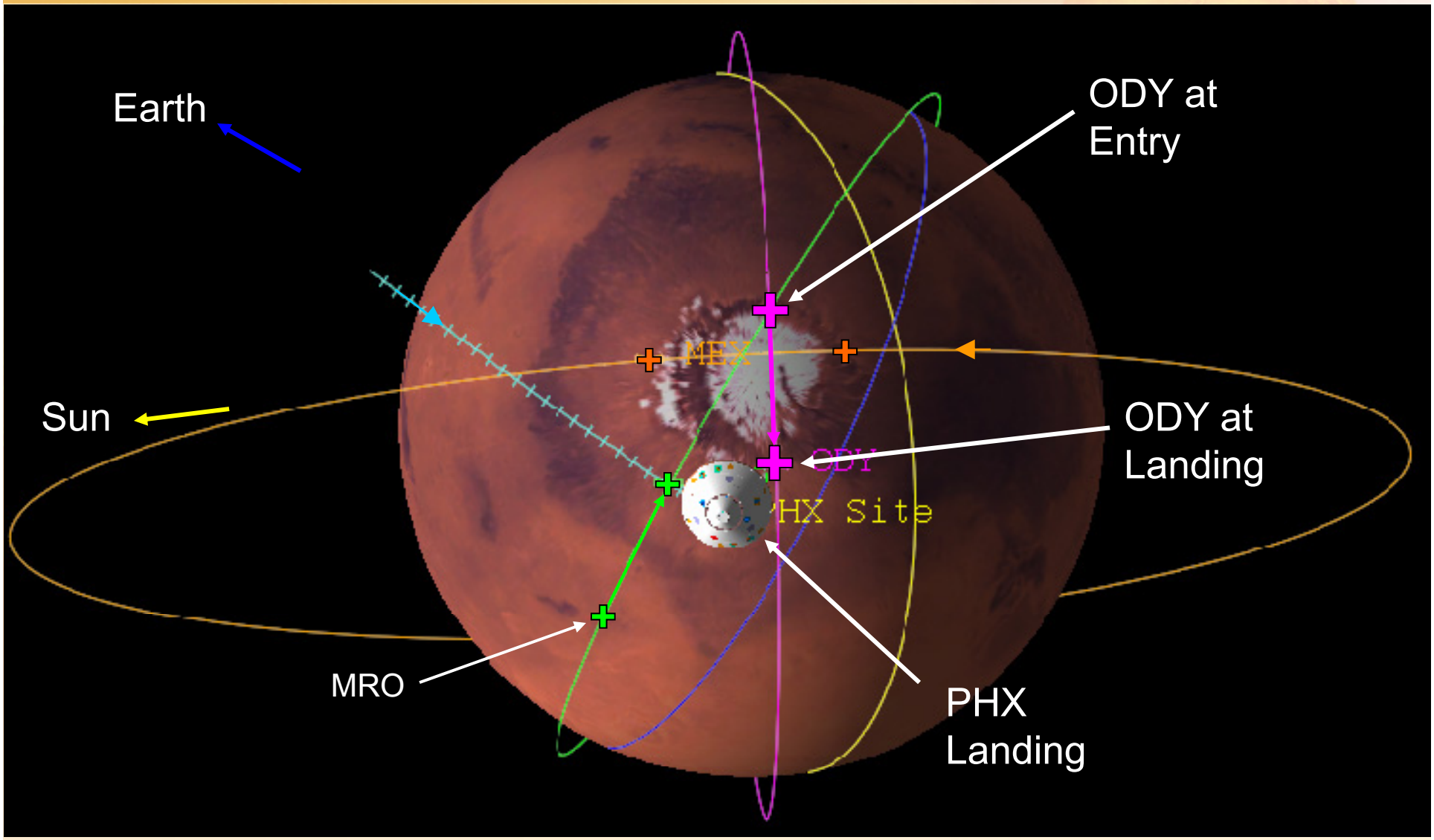


PHX EDL Comm Overview

Orbiters play a critical part of monitoring Entry-Descent-Landing



EDL Geometry (Entry through Landing)



Phoenix Support

Landing Site Characterization

- THEMIS imager has blanketed the entire landing site latitude band
  - Night-time infra-red measurements are good proxy for rock distribution
- PHX mission predicated on original GRS discoveries of ground ice

Entry, Descent, and Landing

- ODY will provide real-time return of PHX EDL data via UHF
- ODY will provide the first landed overflight and data return 2 hrs later
- This will all happen prior to availability of any data from MRO

Surface Operations Support

- ODY will provide command and data return UHF support for all PHX overflights
  - Heavily utilized during early characterization phase
  - ODY orbit geometry is favorable for the AM command pass, late PM data return pass
- ODY flight team very experienced at UHF relay operations
  - UHF relay sequence blocks already onboard the spacecraft
  - Established Contingency plans already in place

Odyssey is integral to the success of the Phoenix mission

Preparations for Phoenix

Orbit Phasing for EDL

- Have been phasing ODY within its orbit to be in place for EDL
  - Daily Angular Momentum desaturations used to slowly adjust the orbit
  - Will be in position by Feb 28, and will station-keep until May 25
  - Contingency phasing maneuver opportunity May 8

EDL Pointing and Timing

- Odyssey points to an inertial attitude (towards PHX) during EDL
  - Attitude designed to enable real-time data return to Earth
- Robust sequence timing to ensure capture of all EDL data

Operational Readiness Tests

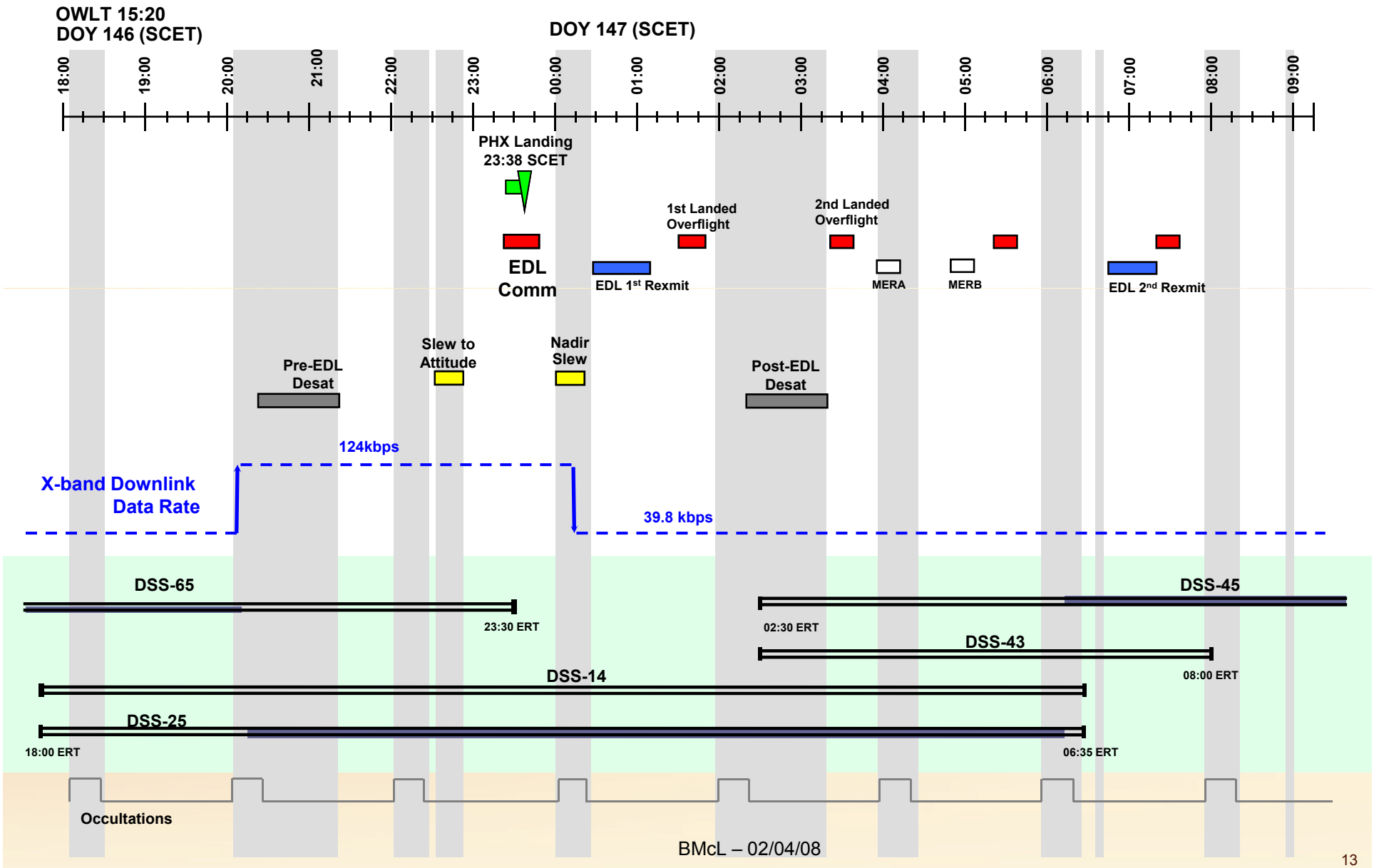
- Significant participation in Phoenix training exercises
  - ORTs 4-10: EDL, Characterization phase, Surface support

Relay Planning

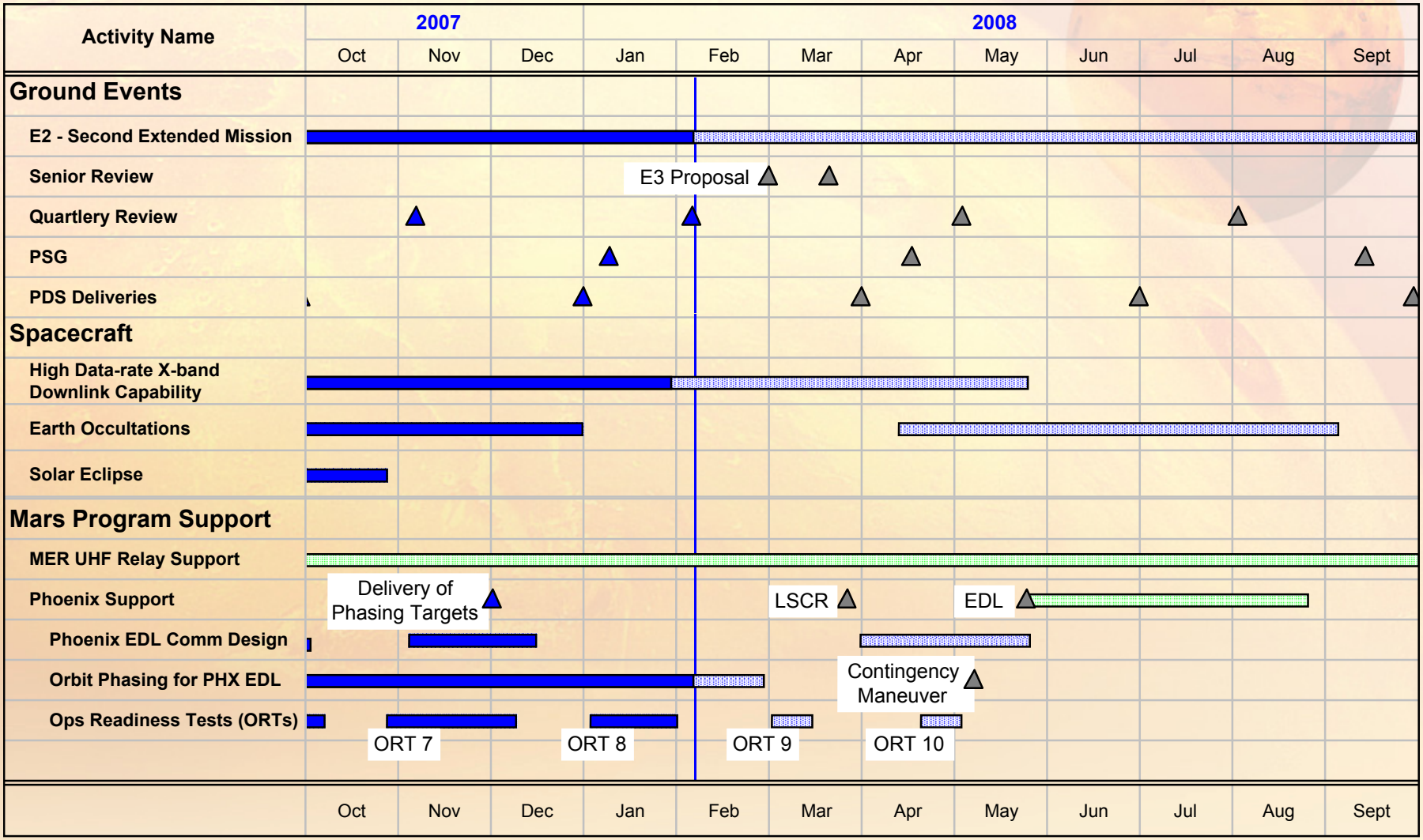
- Established multi-mission UHF relay procedures updated to include new players: PHX and MRO

Odyssey is prepared and ready for Phoenix support

EDL Support Timeline



One Year Rolling Schedule



E3 Rationale

- Continuing Odyssey's operation beyond the E2 mission would address NASA's Mars exploration goals by:
  - Reinforcing Odyssey's role as a long-term asset in the scientific and operational infrastructure at Mars;
  - Providing operational support for critical phases of future missions, such as communications relay, landing site characterization, and atmospheric monitoring for aerobraking;
  - Significantly enhancing the data sets already acquired, extending their temporal and spatial coverage;
  - Enabling new types of observations by operating the instruments and spacecraft in innovative ways.

Spacecraft Status

Spacecraft is healthy, collecting science, supporting MER

- Science Data Return
  - *Approaching 5 terabytes for the mission*
  - *MER data return ~250 Gbits - vast bulk of MER data returned to Earth*
- Consumables
  - *35 kg of propellant, enough to last for another decade*
  - *IMU is component with least lifetime remaining - 3.5 years (Sep 2011)*
    - *No indications of degradation, may be able to preserve life with all-stellar ACS*
  - *7,000 power cycles on UHF radio, lifetime estimate: 8,000-12,000 cycles*
    - *Have already taken measures with MER to preserve radio lifetime*

Issues/Concerns

- B-side high-efficiency power supply (HEPS) shut down
  - *JPL/LMSS Anomaly investigation team assessing cause and risk*
  - *Most likely root cause is an SEU to the over-volt protection switch*
    - *This switch can be reset, and the anomaly would be recoverable*
  - *Awaiting final briefing from OAIT prior to proceeding with any action*

Q & A

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http://mars.jpl.nasa.gov/odyssey